

## 1 FLOOR COVERING WITH BORDERS AND METHOD OF MAKING SAME

2  
3 This invention relates generally to floor coverings and  
4 mats of the type which have a pile surface on the upper  
5 side and a backing layer on the lower side. In  
6 particular the invention relates to rubber-backed floor  
7 mats such as dust control mats or decorative mats of  
8 the type which have a rubber or rubber-like material on  
9 the lower side. Mats of this type are generally used  
10 in access ways where people tend to brush or scrape  
11 their feet in order to prevent carrying of moisture  
12 and/or dirt, accumulated on their footwear, into other  
13 areas of the premises. Normally these mats are located  
14 in areas of high pedestrian traffic, such as doorways.

15  
16 It is desirable for such mats to have a clearly  
17 delineated border, so that users of the mats have a  
18 clear visual indication of the edge of the mat. The  
19 border also serves to act as a frame to the decoration  
20 on the mat, particularly in the cases where mats are  
21 provided with a pattern in the form of a logo or  
22 advertising. Known mats are formed with a backing  
23 layer which has a larger area than the pile layer, so  
24 that the backing layer extends beyond the pile layer on  
25 each of the four sides, forming a contrasting border  
26 which does not have a pile applied to it. It is a  
27 disadvantage of such mats that they must be

1 manufactured individually. The backing layer must be  
2 trimmed to provide a uniform border all the way around  
3 the area of pile. It is a further disadvantage that  
4 the border area is effectively a wasted area, since it  
5 does not have a pile fabric upon it and can serve no  
6 purpose in brushing or cleaning the footwear of users.

7  
8 Therefore, it is an object of this invention to provide  
9 a mat that has a visually recognisable border, but  
10 which has improved cleaning characteristics and can be  
11 manufactured without additional trimming of the backing  
12 layer.

13  
14 In accordance with a first aspect of the invention  
15 there is provided a mat comprising a pile surface  
16 fabric and a rubber or rubber-like backing material  
17 connected to said pile surface fabric, wherein both the  
18 pile surface fabric and the backing material extend to  
19 the edge of the mat, and wherein the pile surface  
20 fabric is provided with a border portion having on its  
21 upper surface a contrasting colour and/or texture to  
22 the remainder of the pile surface fabric and extending  
23 along at least a portion of the edge of said pile  
24 surface fabric.

25  
26 It is to be understood that the edge of the mat may  
27 comprise a plurality of straight edges or one or more  
28 curved edges or a combination of one or more straight  
29 edges and one or more curved edges. The edge of the  
30 mat is understood to be the side surface of the mat  
31 which extends around the perimeter of the mat and  
32 connects the upper and lower surfaces of the mat.

33  
34 It is to be understood that a rubber-like backing  
35 material can include a substantially impervious

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1 flexible sheet material such as natural or artificial  
2 rubber, latex, polyethylene, polyester, polypropylene  
3 and polyamide. Preferably the backing material is a  
4 solid sheet.

5

6 Preferably the border portion of the pile surface  
7 fabric extends along the entire perimeter of the pile  
8 surface fabric.

9

10 Preferably the edge of the mat comprises a cut edge,  
11 whereby the cut edge is the result of a single cutting  
12 operation through the pile surface fabric and the  
13 backing material.

14

15 Preferably the backing material is vulcanised to the  
16 pile surface fabric.

17

18 In the case where the border portion has on its upper  
19 surface a contrasting colour, the border portion may  
20 comprise a printed portion of the pile surface fabric.  
21 Alternatively the border portion may comprise a portion  
22 of the pile surface fabric produced using pre-dyed  
23 yarns. Alternatively the border portion may comprise a  
24 portion of the pile surface fabric produced by  
25 selective melting of the yarns in the pile surface  
26 fabric. Alternatively the border portion may comprise  
27 a portion of the pile surface fabric screened from a  
28 printing or dyeing process applied to the remainder of  
29 the pile surface fabric by selective application of a  
30 liquid repellent to the border portion.

31

32 In the case where the border portion has on its upper  
33 surface a contrasting texture, the border portion may  
34 comprise a portion of the pile surface fabric having  
35 reduced pile height produced by selective melting,

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1 mechanical carving or chemical treatment of the yarns  
2 in the pile surface fabric.

3  
4 In accordance with a second aspect of the invention  
5 there is provided a method for manufacturing a mat  
6 comprising a pile surface fabric and a rubber or  
7 rubber-like backing material connected to said pile  
8 surface fabric, comprising the steps of:

9 bonding a pile surface fabric to a rubber or  
10 rubber-like backing material, the pile surface fabric  
11 having elongate areas of contrasting surface colour  
12 and/or texture,

13 cutting through the pile surface fabric and  
14 backing material along at least one of said elongate  
15 areas to form a mat, wherein the cut portion of the  
16 elongate area forms a border portion of the mat.

17  
18 Preferably the pile surface fabric has longitudinal and  
19 transverse elongate areas of contrasting surface colour  
20 and/or texture forming a grid on the pile surface  
21 fabric. Preferably the pile surface fabric and backing  
22 material are cut along two longitudinal and two  
23 transverse elongate areas to form a substantially  
24 rectangular mat.

25  
26 Preferably the bonding step is achieved by  
27 vulcanization of the rubber backing layer to the  
28 fabric.

29  
30 In a preferred embodiment the method includes the step  
31 of using a visual scanning means, such as a sensor  
32 array or a camera, to scan the pile surface fabric and  
33 identify the position of the elongate areas.  
34 Alternatively the method includes the step of using a  
35 mechanical guide sensor, to identify the position of

1 the elongate areas in the case when the elongate areas  
2 are sculpted or carved, by physically sensing the  
3 change in height of the pile surface fabric.

4  
5 Preferably the method also includes the step of using  
6 an electronic control means to guide a cutting means to  
7 cut through the pile surface fabric and backing  
8 material along a cutting line having a predefined  
9 position with respect to the position of the elongate  
10 area. Preferably the cutting line is predefined as  
11 corresponding to the centre line of the elongate area.

12  
13 In a first preferred embodiment the areas of  
14 contrasting surface colour and/or texture are areas of  
15 contrasting surface colour. The areas of contrasting  
16 colour may be achieved by the step of printing or  
17 dyeing the pile surface fabric, either before or after  
18 the bonding step. Alternatively the areas of  
19 contrasting colour may be achieved by forming the pile  
20 surface fabric with areas which comprise pre-dyed  
21 yarns.

22  
23 Alternatively the areas of contrasting colour may be  
24 achieved by the step of selective application of heat  
25 on the pile surface fabric, wherein the fabric  
26 comprises a blend of fibres of polymers having  
27 different melting points, either before or after the  
28 bonding step. A suitable method of selective  
29 application of heat is described in US Patent No  
30 5,865,933.

31  
32 Alternatively the areas of contrasting colour may be  
33 achieved by the step of selective application of  
34 chemicals containing a liquid repellent on the pile  
35 surface fabric, wherein the fabric is subsequently

1 rewetted by the application of liquid and subject to  
2 heat treatment to carve the areas to which liquid  
3 repellent has been applied, either before or after the  
4 bonding step. A suitable method of selective  
5 application of liquid repellent and heat treatment is  
6 described in US Patent No 5,861,044.

7  
8 Alternatively the areas of contrasting colour may be  
9 achieved by the step of selective application of  
10 chemicals to carve the upper surface of the pile  
11 surface fabric and reveal a lower portion of the pile  
12 surface fabric having a contrasting colour to the  
13 colour of the fibres at the upper surface of the pile  
14 surface fabric.

15  
16 In a second preferred embodiment the areas of  
17 contrasting surface colour and/or texture are areas of  
18 contrasting surface texture. The areas of contrasting  
19 texture may be achieved by the step of selectively  
20 carving areas of the pile surface fabric, either before  
21 or after the bonding step. The carving may be carried  
22 out by acid carving, mechanical carving or shearing.

23  
24 The carving may be carried out by applying a degrading  
25 agent to the pile fibres in the area to be carved,  
26 heating the pile fabric to cause degradation of the  
27 pile fibres and mechanically removing the degraded  
28 fibres. Suitable methods of degrading the fibres are  
29 described in US Patent Nos 4,415,331 and 4,353,706.

30  
31 Alternatively the carving may be carried out by the  
32 step of selective application of chemicals containing a  
33 liquid repellent on the pile surface fabric, wherein  
34 the fabric is subsequently rewetted by the application  
35 of liquid and subject to heat treatment to carve the

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1 areas to which liquid repellent has been applied,  
2 either before or after the bonding step. A suitable  
3 method of selective application of liquid repellent and  
4 heat treatment is described in US Patent No 5,861,044.

5  
6 Other objects and advantages of the invention will  
7 become readily apparent from the following description  
8 of the invention with reference to the accompanying  
9 drawings, in which:

10  
11 Figure 1 is a perspective view of a known dust  
12 control mat;

13 Figure 2 is a perspective view on the rubber  
14 backing sheet and rubber strips of a prior art  
15 dust control mat before placement of the pile  
16 fabric layer;

17 Figure 3 is a section through the prior art mat of  
18 Figure 2 after placement of the pile fabric layer;

19 Figure 4 is a perspective view on a mat according  
20 to an embodiment of the present invention;

21 Figure 5 is a sectional view through the mat of  
22 Figure 4; and

23 Figure 6 is a plan view on a sheet of mat material  
24 used in the method of manufacture according to an  
25 embodiment of the present invention.

26  
27 Referring to Figs. 1 to 3 there is shown a prior art  
28 dust control mat 1 comprising a rubber backing sheet 2  
29 onto which is bonded a pile surface fabric layer 3.  
30 The backing sheet 2 projects on each side beyond the  
31 pile layer 3 to form a border 4. Manufacture of prior  
32 art mats is as follows. First the mat pile is  
33 manufactured in a continuous length on a tufting  
34 machine and is then passed through a dyeing machine to  
35 colour the mat pile. The continuous coloured pile is

1 then cut to size to form the individual pile surface  
2 fabric layers 3. The rubber backing layer is fed from  
3 a continuous roll to a cutting station where it is cut  
4 to size to form individual rubber backing sheets 2.  
5 Each mat is assembled by placing a pile surface fabric  
6 layer 3 centrally on a rubber backing sheet 2 and  
7 feeding the assembled mat through a vulcanizing machine  
8 to bond the fabric 3 to the backing sheet 2. The edges  
9 may be further trimmed to complete the mat manufacture.

10

11 As shown in Fig. 2, rubber strips 5, 6 may be used to  
12 reinforce the borders 4 of the mat, particularly in  
13 cases where a thin rubber backing layer 2 is used to  
14 reduce the weight of the mat 1 and improve handling.  
15 These rubber strips make the assembly of the mat more  
16 complicated. Indeed the manufacture of a single mat  
17 can involve the assembly of up to 20 separate pieces.

18

19 Figs. 4 and 5 show a mat according to the present  
20 invention. In the preferred form of the invention the  
21 mat 10 consists of a pile surface fabric 40 comprising  
22 pile yarns 14 of cotton, polyester, or any suitable  
23 yarn tufted through a woven or nonwoven substrate 16 of  
24 suitable material. The lower parts 18 of the tufts of  
25 pile yarn 14 are adhered to the rubber or rubber-like  
26 backing material 20 during vulcanization. The effect  
27 of a border is achieved by the fact that a border  
28 portion 22 of the pile surface fabric 14 has a colour  
29 which contrasts with the colour of the central portion  
30 24 of the pile surface fabric 14. Typically the colour  
31 of the border portion 22 may be black or a dark colour,  
32 to mimic the black rubber border of a conventional dust  
33 control mat, while the colour of the central portion 24  
34 may be a lighter colour. The effect of the border may  
35 be accentuated by sculpting the upper surface 26 of the



1 tufts of the border 22, as shown in Fig. 5.  
2 Alternatively the effect of the border may be achieved  
3 solely by sculpting the upper surface 26, so that the  
4 border 22 is visible through the effect of shadow from  
5 the raised central area 24 of tufts 14 and/or the  
6 effect produced by the fact that the dark backing layer  
7 20 is more visible through the shorter tufts 14 in the  
8 border 22.

9  
10 It should be noted that the combination of tufts 14 and  
11 substrate 16 may be replaced by a single pile fabric  
12 layer (not shown) if required. The single pile fabric  
13 layer is bonded directly to the rubber backing layer 20  
14 by vulcanization.

15  
16 The contrasting colour of the border 22 may be achieved  
17 in any suitable manner. For example, the border may be  
18 printed with a dye, or the border may be made using  
19 yarn of a different colour to the yarn used in the  
20 central area 24.

21  
22 A preferred method of forming the border with a  
23 contrasting colour is the carving method described in  
24 US Patent No 5,865,933. The pile fabric 40 is formed  
25 of a blend of fibres of two different polymers. The  
26 first polymer has a first colour, while the second  
27 polymer has a second colour. The melting point of the  
28 first fibres exceeds that of the second fibres. When  
29 heat is applied to the area of the pile fabric 40 which  
30 will form the border 22, to a temperature which exceeds  
31 the melting point of the second fibres but does not  
32 exceed that of the first fibres, the second fibres melt  
33 away, leaving the colour of the first fibres  
34 dominating. In the remaining areas 24 in which heat is  
35 not applied, the resulting colour is a blend of the

1 first and second colours. The heat may of course  
2 instead be applied only to the area 24 which will not  
3 form the border 22, to reverse the colours.

4  
5 A further method of carving the border area 22 is the  
6 carving method described in US Patent No 5,861,044.  
7 Chemicals containing a liquid repellent either alone or  
8 with other chemicals such as dye are applied to the  
9 areas of the pile fabric 40 which will form the border  
10 22. The entire pile fabric 40 is then rewetted by the  
11 application of liquid. The printed area 22 containing  
12 repellent remains dry and the areas 24 without  
13 repellent are wetted out. The pile fabric 40 is then  
14 subjected to pressurized heated gas which selectively  
15 carves the dry areas 22 leaving the wetted areas  
16 protected and uncarved. The repellent may of course  
17 instead be applied only to the area 24 which will not  
18 form the border 22, to reverse the carving and/or  
19 dyeing.

20  
21 Fig. 6 shows a plan view on a sheet 30 of mat material  
22 used in the method of manufacture of mats 10 according  
23 to the present invention. The sheet material is  
24 produced by bonding a continuous sheet of pile fabric  
25 material 40, with or without a fabric substrate 16, to  
26 a continuous sheet of rubber backing material 20 by  
27 vulcanization. The top surface of the pile fabric  
28 material is marked with elongate areas in the form of  
29 longitudinal strips 32 and transverse strips 34 which  
30 are intended to form the border areas 22 of the  
31 finished mats 10. The longitudinal and transverse  
32 strips 32 and 34 form a grid pattern on the pile fabric  
33 40. The strips 32 and 34 may be coloured or carved in  
34 any of the methods described above, for example by  
35 printing, dyeing, using yarns of different colours to

1 make the pile fabric, acid treatment, heat treatment  
2 etc. The colouring or carving may take place before or  
3 after bonding the pile fabric 40 to the backing layer  
4 20.

5  
6 The individual mats are then produced by cutting along  
7 longitudinal 36 and transverse 38 cut lines by any  
8 suitable cutting means. Preferably the sheet 30 is  
9 transported to a scanning and cutting station, where a  
10 visual scanning means such as a scanning array sensor  
11 52 is used to recognise the longitudinal and transverse  
12 strips 32 and 34 and to guide a cutting apparatus, such  
13 as a laser cutter (not shown) or a cutting blade 50,  
14 along the cut lines 36 and 38 whose positions are  
15 calculated by an electronic control means (eg  
16 microprocessor, not shown) based on the measured  
17 position of the strips 32 and 34. Alternatively a  
18 mechanical guide sensor can be used to identify the  
19 position of the strips 32, 34 when the strips are  
20 sculpted or carved, by physically sensing the change in  
21 height of the pile surface fabric. Such scanning and  
22 cutting apparatus is known in the art and is not  
23 described further here.

24  
25 The electronic control means guides the cutting means  
26 52 to cut through the pile surface fabric 40 and  
27 backing material 20 along a cutting line 36, 38 which  
28 has a predefined position with respect to the position  
29 of the strips 32, 34. The cutting line 36, 38 may be  
30 predefined as corresponding to the centre line of the  
31 strip 32, 34, or may be predefined as being a  
32 predetermined distance from the edge of the strip 32,  
33 34. Each cut line 36, 38 corresponds to a portion of  
34 an edge of at least one mat 10.

35

1 Preferably the bonding of the pile layer 40 and backing  
2 layer 20 to form a single bonded sheet 30, the printing  
3 and/or carving of the border strips 32, 34 and the  
4 cutting of the single bonded sheet 30 along the cut  
5 lines 36, 38 to form a plurality of individual mats 10  
6 takes place as a continuous process, with the pile  
7 layer 40 and backing layer 20 fed from a roll or rolls  
8 at a first end of the production line and the  
9 individual mats stacked or rolled at a second end of  
10 the production line.

11  
12 The mats produced according to the invention have flush  
13 edges, with the pile yarns 14 extending to the edge of  
14 the mat 10, giving rise to several advantages. The  
15 colours of both the border 22 and the main body 24 of  
16 the mat may be selected to suit the customer's  
17 requirements. The mats are produced in a single  
18 cutting operation, instead of the several separate  
19 cutting and fixing operations of the prior art, making  
20 them economical to produce. The mats serve to clean  
21 footwear over their entire area, since even the borders  
22 are provided with a pile fabric.

23  
24 It is to be understood that the borders produced in the  
25 mat according to the invention can have a contrasting  
26 colour, a contrasting pile height or both contrasting  
27 colour and contrasting pile height when compared to the  
28 main body of the mat.

29  
30 It is to be understood that the mat described above is  
31 a rectangular mat, but that the invention is not  
32 limited to rectangular mats, but includes mats of any  
33 polygonal or other shape which may be manufactured by  
34 an automated manufacturing process, for example square  
35 mats, triangular mats, hexagonal mats, circular mats,

1 oval mats and mats having rounded or chamfered corners.  
2  
3 Although the preferred embodiment of the invention has  
4 been described, it is contemplated that many changes  
5 may be made without departing from the scope or spirit  
6 of the claims and it is desired that the invention be  
7 limited only by the claims.

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